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UNITED STATES DEPARTMENT OF AGRICULTURE
SYLLABUS 18

Contribution from the States Relations Service
A. C. TRUE, Director

In Cooperation with the Bureau of Animal Industry
A. D. MELVIN, Chief



Washington, D. C.

December 9, 1915

ILLUSTRATED LECTURE
ON THE
PRODUCTION OF CLEAN MILK

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U. S. DEPARTMENT OF AGRICULTURE,
STATES RELATIONS SERVICE.

A. C. TRUE, DIRECTOR.

In cooperation with the Bureau of Animal Industry, A. D. Melvin, Chief.

**SYLLABUS 18—ILLUSTRATED LECTURE ON THE
PRODUCTION OF CLEAN MILK.¹**

INTRODUCTION.

The value of the milk and milk products of the United States in the last census year, 1909 (excluding farm consumption of milk and cream), was estimated at \$596,413,463. Adding the probable value of milk and cream used on all farms, the total farm value of all milk and cream produced was probably about \$900,000,000. This is greater than the value of that year's production of such metallic minerals as pig iron, silver, gold, copper, lead, and zinc, and nearly equals the value of the nonmetallic minerals, including bituminous coal, Pennsylvania anthracite, petroleum, natural gas, brick clay, cement, etc., produced the same year.

View.

Undoubtedly the most important use of milk is in its natural form as a human food, or as "market milk." Almost every individual of our population uses more or less milk and often depends largely upon it for sustenance. But most of the milk produced is used for making butter, while a comparatively small amount is used for making cheese. (Ref. 17, p. 3.) It is estimated that the amount of milk produced in this country in 1910 was more than 9,000,000,000 gallons. The number of dairy cows on farms April 15, 1910, was reported as 20,625,432.

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Every owner of a dairy herd should consider it his duty to himself and to the community to keep only healthy cows, supply them with wholesome feed, and keep them in clean, comfortable quarters. He will also find it to be the most profitable way.

¹ This syllabus has been prepared in the Dairy Division of the Bureau of Animal Industry in cooperation with J. M. Stedman, Farmers' Institute Specialist of the States Relations Service, and is designed to aid farmers' institute and other extension lecturers in presenting the subject before popular audiences. The syllabus is illustrated with 49 lantern slides. The numbers in the margins of the pages refer to the lantern slides as listed in the Appendix.

The milkers and all who handle the milk should realize that they have in their charge a food which is easily contaminated, and should therefore take all reasonable precautions to prevent the milk from becoming a source of danger to themselves and to others.

- 3 The consumer should understand that clean, safe milk is worth more and that its production costs more than milk which contains dirt and disease germs; therefore he should be willing to pay more for it than for dirty milk, which is dear at any price. (Ref. 12, p. 130.)

DEFINITION OF CLEAN MILK.

While a rigid application of the definition of the word "clean" would exclude milk which contains foreign matter or any bacteria whatever, for ordinary purposes we may understand clean milk to be healthy cows' milk that is free from dirt and contains only a few bacteria, none of which are of a harmful nature.

- 4 With proper care but few bacteria get into the milk during milking, but they will increase rapidly if the milk is not kept cool until used.

If fresh milk contains a large number of bacteria it indicates that the milk was contaminated during the process of milking, although the bacteria may come from an infected udder.

If milk contains large numbers of bacteria when it reaches the consumer it is because it is not fresh, has come from a diseased cow or has otherwise been contaminated, or because it has not been kept cool. Although such milk may contain no visible dirt, it is not bacteriologically clean and should not be used as food by human beings.

If milk contains large numbers of blood corpuscles or pus cells, it is an indication that the cow that gave it is diseased.

Milk from a diseased cow, from one about to calve, or from one that has very recently calved, possesses abnormal qualities, and though its use may not always be dangerous, it can not be considered as clean milk and should not be used as such.

BACTERIA IN MILK.

- 5 All milk, unless collected under very exceptional circumstances, contains some bacteria. (Bacteria are single-celled plants invisible to the naked eye.) Milk has all the food material and other necessary conditions for bacterial growth. (Ref. 8, p. 5.) The bacteria commonly found in milk grow most rapidly at temperatures between 80° and 100° F. Each

bacterium at maturity divides into two and under favorable conditions the two new individuals may become full grown and then in 20 or 30 minutes repeat the process of division. At a temperature below the most favorable point its growth is retarded but continues slowly. Growth at 70° is rapid; at 50° it is much retarded, and at 40° or below it is very slow. Some bacteria continue to grow, however, even at the freezing point. (Ref. 8, p. 8.)

Many of the bacteria commonly found in milk produce no apparent change in the milk. Others may change the flavor without changing the appearance, while some of the most common types of bacteria cause marked changes in both appearance and flavor. In this class are included the bacteria which sour the milk by converting the sugar into lactic acid and those which form a sweet curd. Another type destroys the casein and albumin in the milk and causes putrefaction and bad odors. (Ref. 8, p. 14.)

The number of bacteria in milk depends on three conditions: First, the number of bacteria in the udder; second, the amount of contamination from outside sources; and, third, the rapidity of the bacterial growth. The rate of growth depends on the temperature at which the milk is held.

SOURCES OF MILK CONTAMINATION.

There are several ways by which bacteria get into milk. Some may come from the udder itself, where they grow in the milk cisterns and ducts. (Ref. 20, p. 103.) The greater number, however, come from the dust of the air, the dirt from the udder and flanks, from the milker, and from unclean utensils. Disease-producing bacteria may get into the milk from cows that have infectious diseases or from people who handle the milk or who have been exposed to such diseases.

The consumer is sometimes responsible for the contamination of the milk. Milk bottles that are to be returned to the dairyman should never be allowed in a sick room. If milk is delivered at houses where there are infectious diseases, the bottles should not be collected until they have been disinfected by the board of health and official permission given for their removal. It is better, however, for the consumer in such cases to receive the milk in a covered dish or in a fiber bottle, which should be thrown away. Milk bottles should not be used to hold vinegar, kerosene, or any liquid other than milk.

IMPORTANCE OF CLEAN MILK TO THE CONSUMER.

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The consumer is interested in clean milk primarily because no one cares to use a food not produced and handled under sanitary conditions. There is a more direct interest, however, because of the danger of contracting disease which may be communicated by this means. Serious epidemics of typhoid fever, septic sore throat, and other diseases have spread by means of the milk supply. The weight of scientific evidence at present leads to the conclusion that tuberculosis may be transmitted from animals to human beings, particularly children, who consume raw milk containing tubercle bacilli. (Ref. 6, p. 8.)

Cleanliness is not an absolute safeguard against disease, but it is the greatest factor in preventing contamination of milk. From the health point of view there is great danger not only from the specific disease-producing bacteria previously mentioned, but from milk that contains large numbers of miscellaneous bacteria which may cause serious digestive troubles, especially in infants and invalids whose diet consists chiefly of milk. There is also the minor consideration of the loss to the consumer by milk souring or otherwise spoiling before it can be used. The cleaner the milk, the longer it will keep good and sweet.

IMPORTANCE OF CLEAN MILK TO THE PRODUCER.

Clean milk not only benefits the consumer, but the milk producer who will consider this subject from an unbiased standpoint will find many ways in which he himself is benefited by producing clean milk. Tuberculin testing, for example, is not only a safeguard to the purity of the milk supply for the consumer, but is a means of assisting the producer to protect his herd against future ravages of tuberculosis. (Ref. 6, p. 6.)

Most producers of market milk have experienced the chagrin of having a shipment of milk refused or returned because it reached the market sour, tainted, or otherwise in poor condition. Although such milk may be used for feeding pigs it usually means a total loss to the producer, on account of the cost to transport it back to the farm and because, depending on the market as an outlet for his milk, he has no means of using small amounts at irregular times. Another important consideration is the unpleasant effect upon the purchaser. To deliver sour or tainted milk usually results in losing the confidence of the dealer, or if it is delivered direct to the con-

sumer, it means loss of custom. A reputation for clean milk means fewer complaints, a better class of patrons, and a steady market for the product of the dairy.

Safeguarding the purity of the milk is in several ways a protection to health on the farm; first, the health of the members of the farmer's family, who use a portion of it themselves; and second, the health of the calves, which live largely on milk. Healthy cows to breed from and pure milk to feed upon are two important factors in rearing thrifty calves and in the development and maintenance of a healthy and profitable herd. Aside from these immediate and definite benefits there is another consideration, not immediately measurable, but of vast influence, namely, the moral influence, for no one can learn to produce good and clean milk without learning good methods of care and management of the herd, and the study of these things leads to greater care and intelligence in the economic features of the business.

THE COST OF MILK.

There has been too much indifference on the part of consumers with respect to the cleanliness of milk; too many of them desire to buy milk at a low price without regard to quality. Dirty milk may prove to be expensive as a gift, while clean milk may be economical even at a high price; the cheapest article is often the most expensive. (Ref. 4, p. 27.) A higher price for clean milk may be a cheap insurance against some form of sickness. It is gratifying to note an increasing demand for good, clean milk. This demand has resulted in more stringent regulations concerning the sanitary conditions associated with the milk supply. Compliance with these sanitary rules requires additional care, attention, and expense on the part of the producer of the milk, and while this expense may not be large, it is only fair that the consumer pay his share of the cost of improving the milk. The consumer can not expect to purchase a clean, safe milk at the same price as a dirty milk which endangers the health of his family. (Ref. 12, p. 130.)

A more serious consideration is the marked increase in the cost of production which has resulted in recent years from feed and labor problems. This increase is in keeping with the increase in the cost of almost all other commodities, and the consumer must expect to pay his portion of any legitimate increase in the cost of production occasioned by these conditions. (Ref. 16, p. 45.)

- On the other hand, there is need of more attention to better management on the average farm devoted to the production of milk. The amount of milk produced per cow is frequently so low as to reflect seriously upon the business ability of the owner. A producer who makes no systematic effort to lower the cost of production by increasing the average production of milk per cow is entitled to little sympathy if he finds the business unprofitable. The profits yielded by a good cow often go to offset losses caused by poor cows in the same stable. (Ref. 13, p. 11.) The keeping of records of production of each individual in the herd, the elimination of unprofitable cows, the improvement of the herd through selection of the best producers and breeding them to a bull of dairy merit, and the selection of the best heifers from such breeding are necessary to put milk production on a sound basis. Unless the producer does these things he disregards the fundamental principles of business economy, and it is unreasonable to expect the consumer to pay him a profit on business practices which represent such economic waste. There is no good excuse for slack business methods on the dairy farm. Directions for keeping records of milk yields and cost of production are furnished by every State agricultural college and by the United States Department of Agriculture.

HOW TO PRODUCE CLEAN MILK.

THE COWS AND THEIR CARE.

- To have healthy cows is one of the first essentials in the production of clean milk. If the cows are diseased, their milk is liable to contain disease-producing bacteria or be otherwise abnormal. Such milk is neither clean nor safe as an article of food, even though there is no visible dirt in it.
- The cows should be tested at least once a year for tuberculosis by a capable veterinarian, and if diseased animals are found the herd should be tested twice a year. All cows which react, showing that they are infected with the disease, should be removed from the herd and the stable and premises thoroughly disinfected. No cattle should be added to the herd without subjecting them to the tuberculin test before they are brought to the farm. They should then be kept separate from the other animals for at least 60 days and retested. Without the use of tuberculin the owner is liable to be confronted with serious and continuous losses; with its use the disease can be eradicated from the herd and the danger of its spread to man from this source removed. (Refs. 3, p. 3; 11, p. 7.)

Special attention should be given to the condition of the udder, and any milk which appears slimy, ropy, watery, or otherwise abnormal should not be used as food. As a rule, milk should not be used within 15 days before calving or during the first 5 days after calving. It is well not to use milk from cows which have been given powerful drugs, for it is known that medicines of this kind often pass through the tissues of the mammary gland and into the milk.

The external condition of the cow is a most important factor in the production of clean milk. One of the greatest sources of milk contamination is the dirt on the animal's body. It is therefore essential that extra care be taken to keep the cow free from accumulations of mud and manure. Grooming is usually dispensed with, as it costs money, yet there is far more reason for the daily grooming of an animal that produces human food than of a horse which hauls a manure spreader or a garbage wagon. Custom, however, demands that the horse be kept clean, and this custom must be extended to include cows on farms where milk is produced. Cows on pasture usually keep cleaner than when in the barn, but though they appear clean they may be very dusty and should be brushed before each milking. When kept in stables they require a thorough cleaning at least once a day. It is well to clip the long hairs from the udder, flanks, and tail in order that dirt may not cling to them. (Ref. 18, p. 150.) It is also desirable that the bedding be clean, dry, and used in sufficient quantities to promote the comfort of the animal, especially where the floor is of concrete.

The cow should not be groomed, bedded, or fed immediately before milking, as these operations fill the stable air with dust and bacteria. Frequent attention to the distribution of bedding is just as important as to supply a large amount of it. Often a tour through the stables the last thing at night and a few minutes' attention to the distribution of the bedding at that time will save half an hour's work of cleaning the cows in the morning. If the manure is daily removed a considerable distance from the stable, bad odors from it can not taint the milk, and the danger of contamination from filth-laden flies is lessened. The fly nuisance is caused by accumulations of manure in which the flies breed, and if conditions are favorable, the manure should be removed to the fields every day. Flies carry bacteria and filth, and earnest efforts should be made to keep them from the stable. If the stable and its surroundings are clean and free from accumulations of manure and other materials which attract flies it can be kept fairly free

20 of them by the use of fly poison and traps. In addition to removing the accumulated manure from the gutter every day, the soiled bedding should be raked back into the gutter and replaced with clean bedding. No animals other than cows should be allowed in the stable. The open-shed system of keeping cows is advocated by many dairymen and has some advantages, but it is essential that the shed be kept dry and be open on the south side. • (Refs. 1, p. 3; 2, p. 9.)

The feed for cows should be palatable and nutritious. Moldy and decayed feed and such feeds as may injuriously affect the cows' health or the character of the milk should be carefully avoided. The odor and flavor of milk are very readily affected by rape, cabbage, turnips, and other feeds having strong odors, and when used they should be given after milking, in which case there is little danger of contaminating the milk. If pastures are overrun with garlic or wild onion, the cows should be removed from the pasture several hours before milking.

21 When silage came into use as a feed for dairy cows there were many objections to it on the ground that it unfavorably affected the flavor of the milk, but these complaints are now less common, as the bad flavors have been found to be caused by poor quality of silage, improper feeding, or because silage odors were absorbed from the stable air. Good silage, fed in reasonable amounts after milking, will not injure the health of the cows nor impair the quality of the milk. It must be fed after milking and all silage not eaten removed so that the silage odors will disappear from the air before the next milking. Many health authorities forbid the feeding of wet brewers' or distillers' grains to cows because such grains ferment rapidly and produce strong odors which are absorbed by the milk, and under ordinary conditions the stable and cows become so filthy that the production of clean milk is impossible.

Owing to the dust and odors which arise from the feeding of hay, grain, and silage it is best, from a sanitary point of view, to feed after milking rather than before. A liberal supply of salt should be provided in a place where the cows can have ready access to it. It is of prime importance that the cows have an abundance of fresh, pure water. Cows which produce 25 pounds of milk a day require 75 pounds or more of water daily, and instances are on record in which heavy milkers have consumed more than 300 pounds of water in that time. This large quantity of water is necessary not only for the formation of milk but also for the digestion and assimilation of the large quantities of food consumed, much of which is

roughage. It is not wise to permit cows to drink large amounts of ice-cold water, and in order to encourage them to drink water enough in extremely cold weather it is necessary to warm it slightly. The water trough should be kept clean and be so situated that the cows when drinking will not be exposed unnecessarily to inclement weather.

THE STABLE.

Whenever possible the cow stable should be on high ground with good, natural drainage. Poultry houses, privies, hog sheds, manure piles, or surroundings which pollute the stable air and furnish breeding places for flies, should not be near the stable.

The silo may be connected with the stable by a feed room, but it should be shut off from the stable by a tight door. This is convenient and also prevents silage odors in the stable except at feeding time. After the silage has been fed the stable can be thoroughly aired before the next milking period.

An ideal site for a barnyard is on a south slope which drains away from the stable. If the barnyard is inclined to be muddy, it should be improved by drainage and by the use of cinders or gravel. A clean yard is a great help in keeping the cows from becoming soiled by mud and manure. (Ref. 15, p. 17.)

Very few farm buildings constructed 15 to 20 years ago meet the sanitary requirements of to-day. Bank barns are generally dark and damp, as the light is often excluded from one or more sides, thus making the stable difficult to keep clean. Stables which have basements open on one side for the manure furnish a breeding place for flies. Barns which have many exposed beams, braces, and ledges, on which dust may lodge, are undesirable. In these old types of buildings little or no attention was paid to proper ventilation and distribution of the light. Many of them, however, can at small expense be remodeled to meet all sanitary requirements.

Construction of the barn may be less important than careful methods in handling milk when the keeping down of the bacterial content of the milk is considered, but the barn construction may be such as to lighten the labor necessary to keep the barn and its equipment in a clean condition.

The stable should have a hard floor which can be readily cleaned; for this reason a dirt floor is undesirable. A cement floor is easily cleaned and prevents waste of the liquid manure; it is liable to be cold, however, and therefore extra bedding is required for the cows.

The gutter back of the cows should be large enough to hold the droppings; one 16 to 18 inches wide and 7 inches deep is usually sufficient; it should incline so as to drain readily, unless the liquid is taken up by absorbents. The best types of stalls and mangers are those which present the least surface for collecting dust and dirt and the least obstruction to the circulation of air. Stalls of wood have many flat surfaces and cracks which are difficult to keep clean and are not easy to disinfect thoroughly when such disinfection is necessary in case of an epidemic. Stalls made of metal pipes are therefore preferable. A swing stanchion is usually preferred, as it allows the cow plenty of freedom. A low, smooth manger without sharp angles is easy to keep clean. If the cows are tied facing the center of the barn, the walkway behind them should be 5 feet or more in width, so that the walls will not be soiled by spattering from the gutter and the manure carrier.

25 The most common defect in dairy stables is a lack of cleanliness; cobwebs on the ceiling and manure on the walls are too common in such places. The dairyman must not allow cobwebs, dust, or dirt to accumulate if he expects to produce the highest grade of milk. With a tight, smooth ceiling and smooth walls without ledges, this is not difficult. Whitewash should be freely applied both to the walls and ceilings at least twice a year, as it helps to purify the stable and to keep it light.

26 An abundance of light is necessary; 4 square feet of glass for each cow is generally sufficient if the windows are well distributed and not obstructed in any way. If the stable is located with its length north and south it receives the purifying benefit of both morning and afternoon sun. (Ref. 15, p. 13.)

27

Every cow stable should have a system of ventilation to keep the air fresh and pure and the cows comfortable without exposing them to injurious drafts. Bad odors in the stable indicate that the ventilation is deficient. At least 500 cubic feet

28 of air space should be provided for each cow. Farmers who desire to provide proper ventilation in cow stables can obtain information on this point by applying to the Dairy Division of the United States Department of Agriculture.

THE MILK HOUSE.

The building in which the milk is handled should be convenient to the barn, but so placed as to be free from dust and stable odors. The ideal place for it is in a well-drained spot somewhat higher than the barn. It should not be near the barnyard, pigpen, privy, or other source of contamination. In cold climates it may be connected with the stable by a covered but

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well-ventilated passageway with self-closing doors at each end to prevent odors from passing from the stable to the milk house. With proper precautions the milk house may be in the same building as the stable, but it should be provided with a separate entrance and the walls between should be tight, without a communicating door or window.

The principal purpose in building a milk house is to provide a place where dairy products may be handled apart from all other operations. To carry out this idea it is necessary to divide the interior of the building into two or more rooms in order to wash the utensils and handle the milk in separate rooms. The milk house and all its equipment should be so planned that unnecessary steps will be avoided and labor economized to the greatest extent. A plan for a small milk house is given in Farmers' Bulletin No. 689. (Ref. 14, p. 1.)

Thorough cleanliness must always be kept in mind; therefore in order to clean the building quickly and thoroughly there should be no unnecessary ledges or rough surfaces in it. Milk-house floors should be of concrete and pitched to drain through bell traps. Round edges at the walls will prevent the collection of dust and dirt. The walls and ceilings may be made of matched boards, but cement plaster on painted metal lathing is better. Ventilators are necessary to keep the air in the milk room fresh and free from musty and other undesirable odors, and to carry off steam from the wash room. Windows are of prime importance, as they let in fresh air and sunlight and also facilitate work. In summer the doors and windows should be screened to keep out flies and other insects.

It is imperative that there be a plentiful supply of cold running water at the dairy house. If it is not possible to have a gravity system, the supply may be piped from an elevated tank fed by an engine, windmill, hand pump, or hydraulic ram. The dairyman can ill afford to spend his time in carrying water in a pail to cool his milk and wash his utensils. Provision must also be made for supplying an abundance of hot water to clean and wash utensils. The water supply should be clean and abundant as well as convenient; otherwise the cleaning will not be thorough. Impure water is a source of contamination that under no circumstances should be allowed on a dairy farm. Outbreaks of typhoid fever in cities have been traced to dairy farms where the wash water was impure. Water which comes from shallow wells receiving surface drainage or seepage from barnyard or house wastes or from pastures is impure and should not be used.

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UTENSILS.

All utensils which come in contact with milk should be made of durable, smooth, nonabsorbent material. Wooden utensils are hard to sterilize, and therefore are not used in the best-equipped dairies. Badly battered or rusty ware is objectionable, as it is hard to clean, and contact with iron may injure the flavor of milk and its products. The use of utensils having complicated parts, crevices, or places which are hard to clean properly should be avoided. (Ref. 15, p. 16.)

32 For the proper sterilization of utensils an abundance of steam or hot water is needed because at 212° F. all the ordinary forms of bacteria are destroyed. All disease-producing bacteria commonly found in milk are destroyed or rendered harmless on exposure to a temperature of 145° F. for 20 minutes. Some bacteria are able to withstand unfavorable conditions by passing into a resistant state known as spores, and are killed only by long exposure to a temperature at or above that of boiling water. A pail or can may appear to be clean and yet may carry numberless bacteria which will hasten the souring of milk, cause bad flavor in butter or cheese, or spread contagion. Milk utensils should be rinsed in cold water immediately after they have been used and before the milk has had time to dry on them, then washed thoroughly in hot water to which soda or some washing powder has been added. For washing dairy utensils, brushes are preferable to cloths, as they are more easily kept clean and do better work. (Ref. 20, p. 84.)

33 After washing, the utensils must be rinsed and sterilized. For the latter they can be immersed in boiling water for at least two minutes or held over a steam jet for the same length of time, but the most effective method is to put them into a tight closet thoroughly sterilized with steam. The utensils
34 while hot should be removed from the steam or water so that they will dry quickly from their own heat, and until used should be kept inverted in a clean place free from dust, flies, or other contamination. Strainer cloths should be washed in the manner described above, boiled for five minutes, and then hung in a clean place to dry.

MILKING.

Unless considerable care is taken, large numbers of bacteria may find their way into the milk during the process of milking. Cows should be milked in clean, well-lighted stables. By taking great pains it may be possible to produce good milk in a dark or dirty stable, but it is extremely improbable that the

average dairyman, under such conditions, will obtain a desirable product. Grooming and feeding the cattle, as well as cleaning the stable and removing the manure, should not be done just before milking, as these operations fill the air with odors, dust, and bacteria which may contaminate the milk. After grooming and before milking, the udders, flanks, and bellies of the cows should be carefully wiped with a damp cloth to remove any dust or loose hairs which might fall into the pail. In some dairies where milk containing an exceptionally small number of bacteria is produced, the cows' udders are washed twice in clean water and then wiped with a clean cloth. Only those persons who are free from communicable disease should be allowed to handle milk or even enter the stable or dairy house. 35

After the cows are prepared for milking, each milker should thoroughly wash his hands and put on clean overalls and a jumper, or wear a suit, preferably white, which is used for no other purpose. The suit must be kept clean and occasionally sterilized with steam or hot water. 36

In modern dairies where clean milk is produced the small-top milk pail is a necessity, as it presents only a small opening into which dust and dirt may fall from the air or from the cow's body. It has been found by experience that the use of a pail of this kind greatly reduces the number of bacteria in milk from dairies where it is used. Many types of milk pails are for sale, but any tinner by the addition of a hood can convert an ordinary pail into a small-top pail. (Ref. 19, p. 249.) 38

Milkers should be allowed to milk only with dry hands. The practice of wetting the hands with milk is a filthy one and in the winter is liable to cause the cows' teats to chap. Milking should be done quickly and thoroughly with no violent jerking of the teats. After each cow's milk is drawn it should be removed immediately to the milk house. 39

The milker should remember always that he is handling a human food which is very easily contaminated. Soap, clean water, and towels must be readily accessible, and the hands should be washed after milking each cow; this is commonly done on many first-class dairy farms. The use of a clean milking stool will do much to prevent soiling the hands. 40

HANDLING THE MILK.

When the milk is taken to the milk house it should be weighed, strained, and cooled at once. The object of weighing is to keep the records of the yield of each cow so as to eliminate the unprofitable cows from the herd. All milk 41

should be strained to remove any dirt that may have fallen into it. (Ref. 23, p. 5.) This is best done through a layer of sterilized absorbent cotton between two cloths, or through several thicknesses of cheese cloth or similar material. Strainer cloths should be always ready for use so that when one becomes soiled another can be substituted immediately.

- 42 From time to time samples of milk from each cow should be taken and tested with the Babcock tester to determine the percentage of fat. While cooling and in storage the milk cans should be kept covered to prevent the entrance of dust, dirt, insects, and other extraneous substances. Warm, fresh milk should not be mixed with the cold milk, as it warms up the milk which has been previously cooled.

In all cases of doubtful purity milk should be pasteurized in order to protect the consumer from dangers that are liable to be incurred by using such milk in the raw state. Pasteurization, however, is not recommended as a substitute for sanitary precautions but as a safeguard in using milk that is not known to be pure enough to be used raw with safety. Pasteurization is best done by heating milk for 30 minutes at a temperature of 145° F. This destroys the bacteria which cause tuberculosis and most other serious diseases, but it does not destroy all the bacteria which produce acid. The process of pasteurizing should not be confused with that of sterilizing, which means absolute destruction of all bacteria.

- 43 To retard the growth of bacteria, milk must be cooled immediately to 50° F. or lower. Ordinarily this can be done most satisfactorily by placing the can in a tank, preferably concrete, containing ice and water enough to come well up on the neck of the can. The cooling will be hastened if the milk is frequently stirred with a clean stirrer. Milk can be cooled more rapidly if it is run over a cooler inside of which is cold running water, but if the air is not pure it will contaminate the milk.
- 44 The milk should be kept in ice water until it is loaded on the wagon to go to the station or receiving plant. By the use of cracked ice placed in the crates bottled milk may be kept cold during transportation. Cans of milk must be protected from the heat of the sun by jackets or by blankets, which will help keep the milk cool, and in winter a covering is needed for the milk to prevent freezing. (Ref. 10, p. 2.)

SCORING DAIRY FARMS.

- 45 The score-card system of rating dairy farms has been found to be one of the best methods of teaching dairy students the science of dairy sanitation, as all the important items are

brought together in a convenient form. It is also of assistance to the dairy farmer, as it calls attention to each item of his equipment and methods separately, and thereby enables him to comply with the requirements of milk inspectors.

TRANSPORTATION.

Milk hauled to the station or factory in hot weather should be covered to protect it from heat and dust. In some places wooden casks are used for carrying milk, but metal or glass is much better because it is more easily cleaned. 46 47

LITERATURE.

Dairy literature, in the form of bulletins issued by the U. S. Department of Agriculture and by the State agricultural colleges, and certain books, give much additional information on the subjects discussed above. 48

Farmers' Bulletin 602 describes quite fully the steps in producing clean milk and is sent free to anyone upon request. 49

APPENDIX.

LANTERN SLIDES.

No. of view.	
8809-B	1. Relative amount of milk used for various purposes in the United States.
5178-C	2. Distribution of milch cows in the United States.
1750	3. Placard showing the value of clean milk.
1761	4. Multiplication of bacteria in uncooled milk.
8-B	5. Kinds of bacteria found in milk.
5168-C	6. Ropy or slimy milk.
7-749	7. Misused milk bottles.
10-B	8. An epidemic of scarlet fever traceable to milk.
5164-C	9. Increase in price of some cattle feeds.
X-101	10. Records of a cow-testing association.
7M-400	11. Chart showing the composition of some cattle feeds.
7M-401	12. Chart showing the composition of some cattle feeds.
3873-B	13. An apparently healthy cow.
2689-C	14. Lesions of tuberculosis from the same cow.
7-694	15. A dirty cow, a menace to clean milk.
7M-432	16. Grooming cows to remove dirt and foreign matter.
1083	17. Clipping long hairs from the udder, flanks, and belly.
7M-74	18. Chart showing the effect of feeding before milking.
5153-C	19. The right way to dispose of the manure—cheap system.
8955-B	20. The right way to dispose of the manure—more expensive system.
7M-6532	21. A good silo, a necessity on the dairy farm.
5171-C	22. Cows are hard to clean when they are kept in a dirty yard.
1301	23. Such a stable is neither sanitary nor comfortable.
7M-82	24. Detail of a sanitary floor and stall.
7-342	25. Clean milk is not easily produced in such a stable.
7-1525	26. A clean, well-lighted stable.
8917-B	27. Ventilation is necessary to provide fresh air in the stable.
18-B	28. Ventilating system, cheaply installed.
977	29. An attractive and inexpensive milk house.
7-573	30. Clean milk should not be handled in such a milk house.
7M-55	31. The interior of a good milk house.
7-450	32. Milk cans airing over a pool of liquid manure.
964	33. A sterilizer for milk utensils.
1176	34. A drying rack for milk utensils.
7M-431	35. Wiping the cows' flanks with a damp cloth just before milking.
7M-71	36. Chart showing the effect of wiping the cows' flanks.
2287	37. Clean milking suits aid in the production of clean milk.
7M-145	38. An easily made small-top milking pail.
7M-70	39. The small-top pail keeps many bacteria out of the milk.
5150-C	40. Milker washing his hands after milking a cow, before milking another.
5149-C	41. Weighing and straining the milk of each cow.
5169-C	42. A Babcock tester for determining the percentage of fat in the milk.
5155-C	43. Cooling milk on the farm.

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8808-B
8806-B
44. Bottles iced in the case for delivery.
 45. Score card for dairy-farm inspection.
 46. Farmers delivering milk to country station.
 47. Delivering milk under difficulties.
 48. Books and bulletins about milk.
 49. Farmers' Bulletin 602, on clean-milk production.

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2. The Computation of Rations for Farm Animals by the Use of Energy Values. U. S. Dept. Agr., Farmers' Bul. 346.
3. The Tuberculin Test of Cattle for Tuberculosis. U. S. Dept. Agr., Farmers' Bul. 351.
4. The Use of Milk as Food. U. S. Dept. Agr., Farmers' Bul. 363.
5. The Care of Milk and its Use in the Home. U. S. Dept. Agr., Farmers' Bul. 413.
6. Tuberculosis. U. S. Dept. Agr., Farmers' Bul. 473.
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9. Production of Clean Milk. U. S. Dept. Agr., Farmers' Bul. 602.
10. Ice Houses and the Use of Ice on the Dairy Farm. U. S. Dept. Agr., Farmers' Bul. 623.
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22. Computing Rations for Farm Animals. New York Cornell Bul. 321.
23. The Milk Sediment Test and its Application. Wisconsin State Sta. Circ. of Inform. 41.



